DETAILED ACTION

The amendment received on 04/22/2008 has been carefully considered. A
response is presented below.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all
obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or
described as set forth in section 102 of this title, if the differences between the subject
matter sought to be patented and the prior art are such that the subject matter as a
whole would have been obvious at the time the invention was made to a person having
ordinary skill in the art to which said subject matter pertains. Patentability shall not be
negatived by the manner in which the invention was made.

2. Claims 13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable
over Kasai et al. 4,214,249 in view of Slinger et. al. "photodoped chalcogenides as
potential infrared holographic media", Applied Optics Vol 31(14) pp.2490-2498
(05/1992) and King et al. 6,721,076.

In example 2 Kasai et al. an optical recording medium comprising a metal dispersed chalcogenide recording material. Silver was used as a diffusible metal and an Ag layer of about 20 nm was formed on the Ge2S3 recording film which had been formed on a polyester sheet. A blanket light irradiation was applied to the Ag+Ge2S3 bi-layer to diffuse the Ag of the diffusible metal layer completely and mutually into the Ge2S3 layer so that an Ag-Ge-S chalcogenide glass was prepared. An image recording was carried out with respect to the chalcogenide glass recording member by using an argon laser(output 200 mW, wavelength of 488nm)(13/11). In addition, copper was employed as a diffusible metal in place of Ag as mentioned above and vacuum-deposited on the Ge2S3 film in a similar manner and blanket light irradiation was applied thereto to prepare a Cu-Ge-S chalcogenide glass(13/55-14/26). Chalcogenides listed in the table at (13/45-50) were also used.

Kasai teaches the use of other chalcogens such as As-S, Ge-S, As-S-Ge, Ge-Se, and others. The reactivity of chalcogen elements is similar to each other so that the various chalcogenides obtained by modifying the above exemplified chalcogenides by changing the chalcogen elements can be effectively used (5/25-49). It is also effective to incorporate to the non-metallic (chalcogenide) layer, a minor amount of metal as an additive for the purpose of improving light sensitivity and the optical density. Representative metal additives may be Ag, Cu, Cd, Mn, Ga, In, Bi, Sb, Fe, Ni and alloys thereof. Ag and Cu are most preferable. The amount of the metal additive may be 1-0.0001 atoms per 100 atoms constituting the non-metallic (chalcogenide) layer. Usually,

0.5-0.005 atoms per 100 atoms are preferable (5/62-6/2).

In regard to the limitation in claim 1 that the content of the metal particle is at least 0.1 vol % and less than 2 vol%, it is held that the teachings of Kasai meets these limitations for the following reasons(which were discussed in the June 6 interview): Kasai teaches 0.0001-1 metal atoms per 100 atoms of chalcogenide and more preferably 0.5-0.005 metal atoms per 100 atoms of chalcogenide. Ag+-1.26 angstroms $2-1.84 angstroms Ge2-2.57 angstroms GES-2.57 angstroms This is approximately a 2:1 ratio (volume of GeS:volume of Ag+).

Example: A film formed according to the teachings of Kasai having one silver atom per 100 atoms of GeS yields a film having 0.49 vol% Ag. This is within the range of 0.1 vol % and 2 vol % recited in claim 1.

In regard to the limitation that the metal particles have a particle size of less than 35 nm, it is held that the teachings of Kasai meet these limitations for the following reasons: Ag+- radius of 1.26 angstroms=0.126 nm A particle having a size of 35nm can contain 277.7 silver ions.

Based on this it is held that the particles dispersed in the chalcogenide glass will have a particle size of 35 nm or less.

In regard to the limitation that the particle size be "less than 35 nm" it is held that the teachings of Kasai meet this limitation for the following reasons: a particle having a

size of 20 nm contains 158.7 silver ions(atoms). Based on this it is held that the

particles dispersed in the chalcogenide glass will have a particles size of 20 nm or less.

Note particle size is interpreted to the radius of the particle.

      In regard to the limitation in claim 1 that "the metal particles be dispersed in the

glass prior to a process of recording material by irradiation of light", the examiner refers

to example 2 of Kasai et al. The step where a blanket light irradiation was applied to the

Ag+Ge2S3 vacuum-deposited film as shown in Fig 5. by means of a xenon lamp to

diffuse the Ag of the diffusible metal layer completely and mutually into

the Ge2S3 so that an Ag-Ge-S chalcogenide glass was prepared(13/61-67), thus

forming a chalcogenide film having metal particles dispersed therein, is a separate and

distinct from the step of image recording with respect to the thus formed chalcogenide

glass (14/1-16). Therefore, it is held that the chalcogenide glass containing dispersed

metal particles is formed before the recording step. See also figures 5-6. As further

evidence for two separate steps, note different light sources used. Xenon lamp used for

formation of Ag-Ge-S glass, and Argon laser(488 nm(1/20X=~24nm)) used for recording

(14/3 and 13/10-11).

      Kasai teaches use of a short wavelength such as from and Argon laser (488nm)

for writing and the use of a long wavelength such as from a He-New laser (630 nm) for

reading (reproducing) the data(7/20-30).

Kasai et al. does not explicitly teach a method of hologram recording.

Slinger et al. teaches that an amorphous chalcogenide layer is deposited by spin coating on to a substrate. A thin metal film is deposited on top of the chalcogenide. Light of a suitable wavelengths is arranged to form an intensity pattern in the chalcogenide, corresponding to the profile of the desired grating. Initially, the actinic radiation is absorbed at the chalcogenide glass-metal interface. This causes growth of metal-doped regions into the chalcogenide. Subsequently, incoming radiation probably absorbed at the un-doped-doped glass boundary, causes further growth of the doped region with a corresponding depletion of the metal reservoir. The silver concentration is uniform throughout the photodoped region(Silver atoms are evenly dispersed). It is important to note that migration(diffusion) of the metal is only along the direction of incoming radiation(page 2491). The chalcogenides used in this paper were arsenic sulfides (As_xS_{i-x}, where 0 <x<1 and x is usually 0.4) with silver as the doping metal, although other chalcogenides and metals are known to exhibit the same effect. The actinic radiation can be anywhere from x-rays through beyond visible red wavelengths. The choice depends on the chalcogenide-metal system and the thickness of the chalcogenide film(pp.2491-2492 grating formation). The photodissolution effect in chalcogenides shows promise as one of the few techniques for producing low-loss holographic materials for use at any given wavelength 600 to beyond 1600nm(abstract). Figure 2. shows the transmittance of the doped and un-doped As2S3 film. In regard to claim 15, the short wavelength end of the transmitting region for the chalcogenide glass

is around 500 nm. This figure also shows the large difference in transmission between

the doped and un-doped material. Figure 3. shows the dependence of the refractive

index of the doped and un-doped films on the wavelength of light. <u>Several bulk</u>

<u>gratings</u>**(both thin and volume types)** <u>have been made</u> **using holographic**

exposures. <u>Recordings were made by using the interference of two plane waves from a</u>

<u>single frequency argon ion laser operating at 514.5 nm</u>(page 2495 top of column 1).

This disclosure teaches a two beam process in which the wavelength of each of

the two beams is equal to ½ of the corresponding optical energy gap of the

chalcogenide.

King et al. teaches that when <u>recording a volume hologram</u>, a large number of

holograms can be stored in the same volume using multiplexing techniques(benefit).

There are several techniques for multiplexing holograms including shift multiplexing,

angle multiplexing, wavelength multiplexing, correlation multiplexing, and phase

multiplexing(l/33-40). Angle multiplexing involves storage of multiple pages of data in

the same photo-recording medium by altering the angle of the reference beam entering

the media during the storage of each page wile maintaining the position of the object

beam(signal beam)(2/38-58).

King et al. does not teach the use of holographic recording in photodoped

chalcogenides. However, this is taught by Slinger, <u>and specific holographic recording</u>

<u>methods including angle multiplexing can be employed in any material capable of being</u>

recorded using holographic recording. Slinger teaches recording metal-doped

chalcogenide recording material using holographic recording methods.

A hologram recording method which employs two beams which include a signal

beam and a reference beam is well known in the art in general and is taught above by

both Slinger et al. and King et al..

It would have been obvious to one of ordinary skill in the art to use the

photodoped chalcogenide film, formed by the application of blanket irradiation to an Ag+

Ge2S3 bi-layer to diffuse the Ag of the diffusible metal layer completely and mutually

into the Ge2S3 layer so that an Ag-Ge-S chalcogenide glass was prepared, taught by

Kasai et al. and to record the photodoped chalcogenide film using a hologram recording

step in which the recording light is composed of a signal and a reference beam based

on the use by Slinger et al. holographic recording methods to record photodoped

chalcogenides. Further, it would have been obvious to employ a holographic recording

method wherein the angle of the reference beam is varied, such as an angle

multiplexing method like that taught by King et al., in order to obtain the benefit taught

by King et al. of being able to form a large number of holograms in the same volume.

The applicant argues that the examiner has interpreted diffused and dispersed to

have the same meaning. This is incorrect. Kasai recites ". A blanket light irradiation was

applied to the Ag+Ge2S3 bi-layer to diffuse the Ag of the diffusible metal layer

completely and mutually into the Ge2S3 layer so that an Ag-Ge-S chalcogenide glass

was prepared". Here the diffusible metal is diffused into the chalcogenide film to form a film in which the metal particles are evenly dispersed therein. The term "diffusion" is interpreted to refer to the movement of the metal particles as a result of light irradiation. The metal particles are recited to be diffusible meaning capable of penetrating and moving in the chalcogen material layer upon irradiation with light. The term "dispersed" is interpreted to be describing the state of the resulting film in which the metal particles are evenly mixed in the chalcogen film. Recording also occurs by irradiating the film, containing a chalcogenide glass having metal particles dispersed therein, causing the diffusion(movement) of the metal particles in the film.

The applicant argues that no rational is provided for combining the angle-multiplexing hologram recording method of King with the Kasai and Slinger. However, this is incorrect. Slinger and Kasai teach substantially similar recording materials. Slinger et al teaches the use of holographic recording methods to form flat and volume gratings in photdoped chalcogenides. King et al. teaches a holographic recording method with stated benefits. It would be obvious to use the angle-multiplexing holographic recording method of King et al. to record photodoped chalcogenide recording materials based on the general use of holographic recording methods by Slinger et al. and based on the specific benefits of the angle-multiplexing method explicitly stated in King et al. (ie you can record more information)

On the bottom of page 3 and continuing onto page 4, the applicant argues that example 2 of Kasai et al. discloses that a silver layer is formed on another layer and subjected to light to diffuse the Ag of the diffusible metal layer completely and mutually into the Ge_2S_3 layers. The examiner points to section (0019) of the applicant's specification wherein a recording medium is fabricated by a manufacturing method comprising the step of simultaneously or alternately forming films of chalcogenide glass and of a metal which is diffusible in the chalcogenide glass by irradiation of light on a substrate material to form a recording layer having metal dispersed in the chalcogenide glass. The method disclosed at (0019) wherein the metal and chalcogenide glass films are alternately formed is analogous to the example in Kasai.

3. Claim 24 rejected under 35 U.S.C. 103(a) as being unpatentable over Slinger et. al. "photodoped chalcogenides as potential infrared holographic media", Applied Optics Vo131(14) pp.2490-2498 (05/1992) and Hosono et al. JP-2001-236002(machine translation provided).

Slinger et al. teaches formation of volume(depth, length, and width) and surface holograms but does not explicitly teach varying the recording light in the direction of the depth of the recording layer in the recording step.

Hosono et al. teaches a hologram recording method in which two-beam laser interference exposure method is used to irreversibly record in a transparent material

semi conductor material or metal material(abstract). Formation of holograms in a

hologram recording step by varying the incidence location of the two beams in the depth

direction is taught at(0018). See also (0041).

It would have been obvious to one of ordinary skill in the art to use the

photodoped chalcogenide film, formed by the application of blanket irradiation to an Ag+

Ge2S3 bi-layer to diffuse the Ag of the diffusible metal layer completely and mutually

into the Ge2S3 layer so that an Ag-Ge-S chalcogenide glass was prepared, taught by

Kasai et al. and to record the photodoped chalcogenide film using a hologram recording

step in which the recording light is composed of a signal and a reference beam based

on the holographic recording methods on similar photodoped chalcogenides by Slinger

et al.. Further, it would have been obvious to employ a holographic recording method

wherein the recording light is varied in the direction of the depth of the recording layer

as taught by Hosono in order to achieve volume holograms.

The applicant argues that no rational is provided for combining the hologram

recording method of Hosono et al. with Slinger. However, this is incorrect. Slinger et al

teaches the use of holographic recording methods to form flat and volume gratings in

photdoped chalcogenides. Hosono et al. teaches a holographic recording method. It

would be obvious to use the holographic recording method of King et al. to record

photodoped chalcogenide recording materials based on the general use of holographic

recording methods by Slinger et al. and with a reasonable expectation of being able to

record at various depths.

Conclusion

4.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time

policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within

TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later

than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to ANNA L. VERDERAME whose telephone number is

(571)272-6420. The examiner can normally be reached on M-F 8A-4:30P.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Mark Huff can be reached on (571)272-1385. The fax phone number for the

organization where this application or proceeding is assigned is 571-273-8300.

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USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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